Anemia and Insufficient Milk in First-Time Mothers

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ABSTRACT: *Insufficient milk is a poorly understood problem that is often identified as a major reason for early discontinuation of breastfeeding. This study explored the relationship between anemia and insufficient milk in 630 first-time mothers. The frequency of anemia (postpartum hemoglobin < 10 g/dL) was 22 percent. Anemic mothers reported a higher level of symptomatology associated with insufficient milk and were more frequently classified as having insufficient milk syndrome. Mothers with the syndrome reported a shorter period of full breastfeeding, and weaned at an earlier age. They identified not having enough milk, baby nursing too often, and baby not gaining enough weight as the main reasons for discontinuing breastfeeding, compared with baby's disinterest and conflicts with school or work as main reasons among mothers not reporting symptoms related to insufficient milk syndrome. The study results suggest that anemia is associated with the development of insufficient milk, which in turn, is related to duration of full breastfeeding and to age at weaning. (BIRTH 22:2, June 1995)*

Breastfeeding is the recommended method of infant feeding because it is associated with important health outcomes for infants and mothers. Yet recent data showed that only 52 percent of new mothers in the United States initiated breastfeeding, and many of them continued the practice for only short periods of time (1). Maternal perception of an insufficient milk supply is often given as a reason for weaning and subsequent feeding of a human milk substitute early in the postpartum period (2–8).

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Literature Review

Symptomatology of Insufficient Milk Syndrome

Insufficient milk syndrome has been defined in the literature by the mother's perception that the quantity or quality of her milk is insufficient to satisfy the infant, or is evidenced by inadequate infant weight gain (9). Women with the syndrome describe a history that typically includes a baby who demands to eat frequently and who fusses after feedings, delay of feeding until breast fullness is felt, and supplementation with human milk substitute in an attempt to quiet the infant (10). These women often believe that the breasts must be full and hard to their touch for sufficient milk for a feeding to be available. The bluish color and thin consistency that are characteristics of human milk are cited as proof that the quality of the milk is poor.

Ultimately, insufficient milk syndrome includes many maternal, infant, and breastfeeding transaction characteristics (7, 9). Maternal indicators are decreased milk maturation rate, decreased confidence and relaxation, and dissatisfaction with the experience. Infant indicators include fussiness, frequent feedings, short sleep intervals, and slow rate of weight gain. The pattern of breastfeeding in women with the syndrome is

characterized by the use of supplemental human milk substitute and pacifiers.

Determinants of Insufficient Milk Syndrome

A conceptual explanatory model proposed maternal time constraints, sociocultural characteristics, maternal comfort, and infant characteristics as having an indirect effect on the syndrome (7). Breastfeeding behavior, and maternal psychological and physiologic influences on milk production were identified as direct causes. When parts of this model were evaluated empirically (9), correlations of potential indirect determinants with the syndrome were modest; the highest correlation was with maternal confidence ($r = 0.22$, $p < 0.05$).

Portions of the model were also examined within the theoretical context of a planned behavior-based structural model (11) for breastfeeding duration (Duckett LJ, et al, submitted). Many of the predictor variables in that model overlap with those thought to be predictive of insufficient milk, such as maternal education, maternal attitudes and knowledge about breastfeeding and bottle-feeding, attitudes of family and friends, and feelings of control over breastfeeding (12,13). Using these variables, it was possible to predict insufficient milk significantly only for women who were employed part-time. These indirect influences were unrelated to insufficient milk in women who were more fully employed or who were homemakers.

Both of these evaluations emphasized psychosocial determinants of the insufficient milk syndrome. Breastfeeding is an unusual social behavior because it also involves complex physiologic mechanisms. More direct influences on the outcome, such as indicators of maternal health status, may have an important impact on the development of insufficient milk.

Anemia During Pregnancy and the Puerperium

A mild decrease in hemoglobin is a normal physiologic response to the increases in intravascular volume and demand for erythropoiesis during pregnancy. At the same time, clinically significant anemia occurs with such great frequency during pregnancy that it was referred to as "the most common medical complication of pregnancy" (14).

Anemia during pregnancy is associated with a range of symptoms. Some women may be asymptomatic. Many report becoming tired easily. Anemic women are increasingly susceptible to infection and postpartum hemorrhage, and have poor tolerance for even minimal blood loss during birth (15).

Less is known about the impact of anemia on postpartum adaptation. Fatigue, an extremely common complaint among new mothers, is usually attributed to sleep disruption for infant care (16). Among breastfeeding mothers, evidence suggests no relationship between anemia and levels of iron in their milk. Thus, the quality of milk seems unaffected by maternal hemoglobin; however, the relationship is relatively unexplored (17).

The development of data base models has been restricted primarily to psychosocial variables. We complemented that work with an empirical evaluation of the association between anemia, an important physiologic indicator of maternal health status, and insufficient milk in 630 first-time mothers.

Methods

Recruitment and Sample

A total of 2950 new mothers were screened at one large private urban hospital in the north central United States as part of a larger study designed to develop a structural model explaining breastfeeding duration of first-time mothers (Duckett, LJ, et al, submitted). Of these women, 966 (33%) were breastfeeding primiparas, and 832 met eligibility criteria for the larger study (at least 18 yrs old; speaks, reads, and writes English; no serious maternal illness; full-term infant receiving normal newborn care). In all, 695 women consented to participate in the study, and 633 completed packets of initial data. The primary reason for refusal to participate or failure to complete the initial data packet appeared to be lack of time during the short postpartum hospital stay. Data related to hemoglobin and insufficient milk were available for 630 women. Of these, 625 (98.7%) provided data about duration of full breastfeeding, and age at weaning was known for 606 (95.7%). Once women began actual participation in this longitudinal study, attrition was extremely low and unlikely to have influenced any findings.

The participants ranged in age from 18 to 41 years (mean 28, SD 5.0 yrs). Most (533, 85%) were married and well educated; only 3 percent had not completed high school, and 53 percent had completed an undergraduate program. Ninety-four percent received prenatal care from a physician or a nurse-midwife at a large health maintenance organization or a private clinic. The remaining 6 percent received care in clinics serving low-income populations. Most women (505, 80%) delivered their infants vaginally.

Procedure

Mothers completed an initial battery of questionnaires before hospital discharge that provided biographical information and other data related to breastfeeding and employment plans, breastfeeding attitudes and knowl-

edge, and perceived support for breastfeeding. Postpartum hemoglobin levels were gathered from patient records.

Women were recontacted by telephone at 1, 3, 6, 9, and 12 months. Those still breastfeeding at 12 months were contacted every three months until the baby was weaned. Data collection at one month included a questionnaire about breastfeeding difficulties. The date of infant weaning was noted at the data collection time closest to weaning. A questionnaire about weaning, including reasons for weaning, was mailed to the mother.

Variables and Measurements

Women with postpartum hemoglobin less than 10.0 g/dL were classified as anemic. Most (60.5%) hemoglobin values (recorded from the patient hospital record) were determined on the first postpartum day; some (36.5%) were measured after the baby was born on the day of delivery, and the rest (3%) on the second or third postpartum day.

The use of low hemoglobin values to identify subjects with anemia is typical of the procedure employed in primary screening, but not for clinical diagnosis, in which follow-up laboratory studies such as serum ferritin, transferrin saturation, and erythrocyte protoporphyrin may be indicated. A hemoglobin of 10 mg/dl or less is associated with readily apparent adverse effects, including significant fatigue, fainting, and susceptibility to infection (18). This cut-off point is lower than the minimum hemoglobin recommended for screening for anemia at any stage of pregnancy (19), and thus is a conservative identification of anemia. (Normal values for the immediate postpartum period were not located, despite the ubiquity with which hemoglobin is measured for clinical diagnosis and management of anemia within the two days after delivery.) In addition, the researchers generally agreed that this level corresponded with a value that would be considered clinically significant in any situation.

Maternal report of breastfeeding problems that indicated insufficient milk were used as the basis for measuring the adequacy of the quantity of milk and to determine insufficient milk syndrome. Women rated insufficient letdown, not enough milk, baby not gaining weight, baby wanting to nurse too often, and baby crying or dissatisfied on a scale of 0 (no problem) to 7 (major problem). These ratings were summed to produce scores with a possible range of 0 to 35, with high scores reflecting insufficient milk. Women with scores greater than or equal to 15 were classified as insufficient milk syndrome-positive, as described in the results and discussion.

Full breastfeeding was defined as the number of weeks from birth during which the infant was fed only breast milk, water, sugar water, or diluted juices (20). The age at weaning was defined as the number of weeks from birth that the infant received any amount of breast milk. Full, partial, and token breastfeeding may have occurred before complete weaning. A typical pattern is exclusive or full breastfeeding at birth, partial breastfeeding as solid foods are introduced, and token breastfeeding for comfort before weaning (Henly SJ et al, in preparation).

At the time of weaning, mothers checked all reasons for weaning from a list of 33 items, and noted the primary reason. It was also possible to list other reasons, but few women exercised this option, indicating that the list of possible reasons was complete.

Results

Frequency of Anemia and Insufficient Milk

Hemoglobin values ranged from 6.7 to 14.5 g/dL (mean 11.0, SD 1.30). For 137 women (22%) the values were less than 10.0 g/dL, and they were classified as anemic.

Scores on the measure of insufficient milk ranged from 0 to 34 (mean 6.6, SD 6.91, median 4.0). Skew of the distribution was 1.39 and was obvious in a graph of the scores. The distribution of scores suggested that many new mothers reported minor difficulty with some of the problems associated with insufficient milk while establishing breastfeeding. Those who reported major problems across a few indicators or some problems across most indicators probably experienced insufficient milk syndrome. The 83 (13%) women in the right-hand tail of the distribution with scores greater than or equal to 15 were regarded as positive for the syndrome.

The cross-classification of symptomatic anemia and the syndrome is given in Table 1. The percentage of women reporting the syndrome was greater for those with anemia (19.7%) than for those without anemia (11.4%). The χ^2 test for independence was significant ($\chi^2 = 6.53$, $df = 1$, $p < 0.01$). The estimated relative

Table 1. Anemia and Insufficient Milk Syndrome

	Insufficient Milk Syndrome		
Anemia	*No*	*Yes*	*Totals*
No	437 (88.6%)*	56 (11.4%)*	493
Yes	110 (80.3%)*	27 (19.7%)*	137
Totals	547 (86.8%)*	83 (13.2%)*	630

** Row percentages.*
$\chi^2 = 6.53$, $p < 0.01$.

risk for insufficient milk syndrome associated with anemia was 1.7.

A significant difference was also observed between the groups with and without anemia on the continuous measure of insufficient milk ($t = 2.08$, $p < 0.04$). The mean score for the anemic group was 7.7 (SD 7.37), compared with 6.3 (SD 6.75) for the normal group.

Insufficient Milk Syndrome, Anemia, and Duration of Breastfeeding

Mean values for duration of full breastfeeding and infant age at weaning are listed as a function of maternal anemia and the syndrome in Table 2. Two-way analysis of variance was performed to test mean differences in duration of full breastfeeding and infant age at weaning for the main effects and interaction.

Both the duration of full breastfeeding and the infant age at weaning were significantly shorter for the women with insufficient milk syndrome. Averaging across anemia status, women without the syndrome breastfed fully for 10.5 weeks (SD 8.09 wks), compared with a mean of 3.8 weeks (SD 5.52 wks) for those with the syndrome. The mean difference in duration of full breastfeeding of 6.7 weeks would be judged clinically significant as well.

Age of infant at weaning for women without insufficient milk syndrome averaged 30.7 weeks (SD 27.19 wks), compared with an average age of 12.1 weeks (SD 19.26 wks) for the infants of women with the syndrome. The mean difference in age at weaning of 18.6 weeks is dramatic and emphasizes the critical role that this condition can play in determining duration of breastfeeding.

No significant differences were observed in duration of full breastfeeding or infant age at weaning for women with and without anemia. Regardless of insufficient milk syndrome status, anemic women breastfed fully for an average of 9.0 weeks (SD 7.94 wks), compared with 9.8 weeks (SD 8.17 wks) for nonanemic mothers. The average age at weaning was 26.1 weeks (SD 26.17 wks) and 28.7 weeks (SD 27.23 wks), respectively. The interaction between insufficient milk syndrome and anemia was not significant for either duration of full breastfeeding or age at weaning.

Reasons for Weaning

Primary reasons for weaning given by mothers in each of the anemia-insufficient milk syndrome groups are shown in Table 3. The greatest single reason given for weaning by women in the insufficient milk syndrome

Table 2. Duration of Full Breastfeeding and Infant Age at Weaning by Anemia and Insufficient Milk Syndrome

			Full Breastfeeding		*Age at Weaning*	
IMS	*Anemia*	*N1/N2*	*Mean*	*SD*	*Mean*	*SD*
Yes	No	56/54	4.14	6.22	14.26	22.93
Yes	Yes	27/27	3.11	3.67	7.63	6.22
No	No	434/422	10.57	8.11	30.59	27.21
No	Yes	109/103	10.49	8.04	30.91	27.26

N1 = sample size for full breastfeeding; N2 = sample size for infant age at weaning.
The insufficient milk syndrome effect is significant for full breastfeeding ($F_{622,1} = 52.759$, $p < 0.0001$) and infant age at weaning ($F_{602,1} = 34.197$, $p < 0.0001$).

Table 3. Primary Reason for Weaning

	Insufficient Milk Syndrome		*No Syndrome*	
Primary Reason	*Anemia (%)*	*No Anemia (%)*	*Anemia (%)*	*No Anemia (%)*
Not enough milk	29.6	20.8	13.4	7.9
Infant nurses too often	0.0	7.5	3.1	1.7
Infant not gaining weight	3.7	9.4	0.0	0.5
Not interested	7.4	9.4	14.4	16.3
Sore nipples/breast pain	3.7	11.3	0.0	4.2
Work/school conflict	11.1	11.3	20.5	18.0
Time seemed right	0.0	1.9	17.5	16.1
Remaining combined	44.5	28.4	31.1	35.3
Number responding	27	56	110	437
% Responding	100	95	89	93

groups (regardless of anemia status) was insufficient milk. Other reasons related to insufficient milk, such as baby nursing too often or not gaining weight, were also identified.

In sharp contrast, women without the syndrome listed employment conflicts, infant disinterest, and "time seemed right" as the primary reasons for weaning. Some of these women also reported that insufficient milk was the most important reason, but much less frequently.

No particular pattern of reasons for weaning seemed to differentiate anemic and nonanemic mothers. Anemic mothers reported that "not enough milk" was the main reason for weaning more often than nonanemic mothers in both groups.

Discussion

Conceptual models for insufficient milk syndrome suggest physiologic, emotional, and social causes. Previous attempts at empirical validation of the models focused on the effects of indirect determinants of a psychosocial nature and demonstrated only a modest relationship with the syndrome. The data reported here suggest that anemia, an important indicator of maternal health, is associated with the development of insufficient milk. Insufficient milk, in turn, was related to duration of full breastfeeding and even more dramatically to age at weaning. There was no evidence of a direct impact of anemia on breastfeeding duration.

Our findings constitute a secondary analysis of data from a larger study. Certain measurement and design limitations suggest conservative interpretation of the findings and provide guidance for ways to improve follow-up research. In this study, breastfeeding durations were shorter for anemic than for nonanemic women, but the differences were not statistically significant. A much larger sample would be required to reject a null hypothesis of no differences in breastfeeding durations for these groups, given the effect sizes reported here. Assuming a type I error rate of 0.05 and power of 80 percent for a one-tailed test, a total of 1250 subjects would be required (21).

There is a consensus in the literature that breastfeeding women worldwide cite insufficient milk as a primary reason for early weaning and introducing human milk substitutes into their babies' diets. In contrast, scientific understanding of insufficient milk reflects diversity of opinion about the nature of the phenomenon. A critical conceptual issue revolves around the veracity of maternal reporting of insufficient milk: is there really not enough milk, or do women's reports reflect a misperception of insufficiency? Our measurement procedure implies a belief in the reality of the syndrome, in the sense that indicators such as impressive display of hunger cues by the baby or slow infant weight gain suggest that the baby actually receives insufficient milk. At the same time, it seems clear that misperceptions of insufficient milk related to lack of knowledge about the process of lactation, in conjunction with a typical response that includes artificial feeding, will likely produce a real reduction in milk supply.

Insufficient milk can be considered a continuous variable or a discrete phenomenon reflecting a syndrome. Measurement procedures such as the one we used imply continuity, despite emphasis in the literature on the idea of a syndrome. In this study, we regarded scores in the upper 13 percent of the skewed distribution as indicating insufficient milk syndrome. The highly skewed distribution of the continuously varying insufficient milk scores provided some justification for the idea of a syndrome. The fact that women in the insufficient milk syndrome groups identified problems with milk supply as reasons for weaning at a relatively high rate was other initial evidence that this empirical approach to identifying cases with the syndrome was valid.

Hemoglobins that were used to identify anemia were clinical values obtained from patient records. Information about treatment for anemia was not available. The in vivo measurement procedure reflected standard clinical practice and was relatively uncontrolled. Future studies should include a protocol that would ensure that postpartum hemoglobins did not reflect any parturition-related dilutional effects. Treatment for anemia should be described, and follow-up blood studies should be completed.

Selection of a criterion representing completeness and duration of breastfeeding poses interesting design questions. We studied the duration of full breastfeeding and age at weaning. By definition, women who breastfeed fully also give limited amounts of water, sugar water, and dilute juices to their infants. Thus, the criterion was contaminated to some degree by factors thought to influence insufficient milk syndrome.

Nonexclusive breastfeeding was practiced by many study participants, and is common among breastfeeding women in the United States. Our study was observational, and no attempt was made at any time to influence breastfeeding behavior of participants. Despite the preference for experimentation in scientific studies, it is doubtful whether any feeding protocol could be developed without provisions for responding to alterations in infant health status or even a woman's desire to deviate from an established protocol for any reason.

The best approach to the criterion problem may be careful observation and measurement of actual breastfeeding patterns of women and their infants. For

the purposes of this research, comprehensive feeding histories for a very large number of subjects obtained at 1, 3, 6, 9, and 12 months, and every 3 months thereafter until weaning, sufficed. Other studies may require more intensive monitoring of a smaller number of breastfeeding couples over a shorter period of time. Either approach requires an exhaustive effort by research staff.

Psychosocial variables provide an understanding of the context in which insufficient milk syndrome occurs. Yet, work to date does not suggest that these indirect causes provide information that is especially useful for prediction in individual cases. For case finding and intervention, maternal health status and behavior characteristics of the breastfeeding relationship are probably more potent indicators of impending insufficient milk syndrome. The data reported here suggest that maternal anemia could play a role in the development of the condition, and might reasonably be a factor for assessment when women complain of insufficient milk.

Anemia is sometimes regarded as the most frequently occurring medical complication of pregnancy. Yet, the high frequency should not suggest that anemia is normal and without consequence. In this sample, we noted an association between anemia in the immediate postpartum period and maternal report of insufficient milk at one month. This prompts the question of whether these women were behaviorally unable versus physically unable to breastfeed (22).

Fatigue, which is a common complaint associated with anemia, has been implicated as the major factor influencing milk supply early in the postpartum period (23). One behaviorally oriented explanation for the association between anemia and insufficient milk may be that the fatigue of anemia interferes with a woman's intention to breastfeed; she simply may be too tired to respond to infant feeding cues, and request that a milk substitute be provided by someone else to permit her to rest. Such behavior would disrupt the demand-supply relationship between infant and mother that is crucial to maintaining an adequate milk supply. Alternatively, there may be some direct physical effect of low hemoglobin or fatigue on milk production.

The frequency of insufficient milk syndrome and its deleterious effects on breastfeeding duration have been documented. Our findings corroborate those results, and emphasize the need for better understanding of the phenomenon.

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